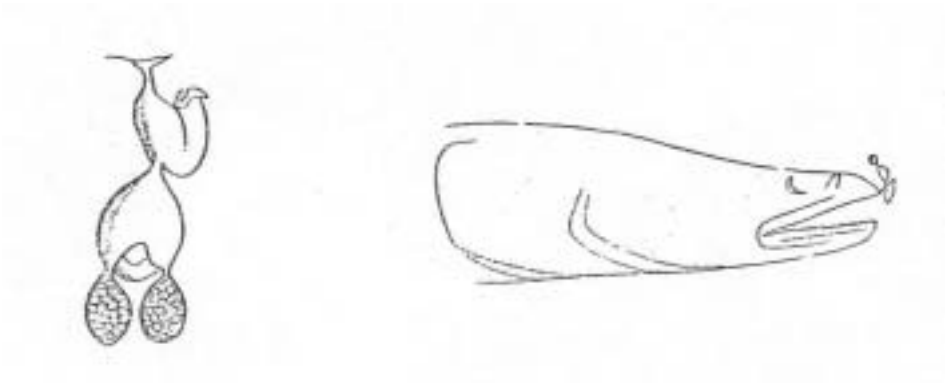
Conservation Assessment
for
Northern Cavefish Copepod (Cauloxenus Stygius)



(Cope, 1872)

USDA Forest Service, Eastern Region

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This Conservation Assessment was prepared to compile the published and unpublished information on Cauloxenus Stygius. It does not represent a management decision by the U.S. Forest Service. Though the best scientific information available was used and subject experts were consulted in preparation of this document, it is expected that new information will arise. In the spirit of continuous learning and adaptive management, if you have information that will assist in conserving the subject community and associated taxa, please contact the Eastern Region of the Forest Service Threatened and Endangered Species Program at 310 Wisconsin Avenue, Milwaukee, Wisconsin 53203.

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EXECUTIVE SUMMARY

The Northern cavefish copepod is designated as a Regional Forester Sensitive Species on the Hoosier National Forest in the Eastern Region of the Forest Service. The purpose of this document is to provide the background information necessary to prepare a Conservation Strategy, which will include management actions to conserve the species.

The Northern cavefish copepod is a rarely seen parasitic microcrustacean that occurs on the Northern cavefish in Kentucky and Indiana.

NOMENCLATURE AND TAXONOMY

Classification: Class Crustacea
Order Eucopepoda
Suborder Lerneopodoida
Family Lerneopodidae

Scientific Name: Cauloxenus stygius

Common Name: Northern cavefish copepod

Synonyms: none

This species was described by Cope (1872). Although the description is poor, the unique nature of this copepod as an ectoparasite of the Northern cavefish makes it identifiable.

DESCRIPTION OF SPECIES

Cauloxenus stygius is a microcrustacean. The ectoparasitic copepods assume bizarre modifications due to their parasitic nature that makes them unrecognizable as typical copepods. Cauloxenus was described by Cope (1872) as having an elongate cephalothorax with heavily modified mouthparts and an oval trunk lacking obvious segmentation. Specific identification of this species requires microscopic examination by a specialist familiar with copepod systematics.

LIFE HISTORY

Nothing is known of the life history of this species other than it has been observed that in one of the stages of the life cycle it is a parasite upon the Northern cavefish (Amblyopsis spelaea). Yamaguti (1963) reported that males were unknown.

HABITAT

Cauloxenus stygius is an obligate ectoparasite upon a troglobitic fish (Amblyopsis spelaea) and is therefore troglobitic by association. Amblyopsis usually occurs in base level cave streams with pools deep enough to sustain it. Cope (1872) reported the copepod as being taken from the upper lip of the fish. Giovannoli (1933) reported that the copepod had also been noted on the lip of the Northern cavefish in Mammoth Cave, Kentucky.

DISTRIBUTION AND ABUNDANCE

This species is seen very rarely. Dr. Thomas Poulson reported to me (personal communication) that in all of his work with cavefish he had seen only one of the copepods.

Cauloxenus stygius was recorded by Blatchley (1897) from a confusing locality:

"attached to an Amblyopsis in the same manner as described by Prof. Cope. From a cave in Bradford, Orleans Co., Indiana, by Dr. John Sloan, who had the fish and its parasite alive in an aquarium for nearly a year."

The stream in Bradford Cave is small and shallow - cavefish are not known to occur there. There is no Orleans County in Indiana. This record probably refers to the well at Orleans, in Orange County (part of the Lost River groundwater system) from which Smith (1888) collected and described the subterranean amphipod Crangonyx packardi.

The distribution is presumed to be that of the host organism, the Northern cavefish Amblyopsis spelaea. This fish is found in caves from the Mammoth Cave area of central Kentucky north into Indiana as far as the East Fork of White River drainage. In the Hoosier National Forest A. spelaea has been recorded from Elrod, Wesley Chapel Gulf, Dillon, Henshaw Bend and Springs Spring caves as well as Pioneer Mother's Spring (Keith, 1988; Lewis, et al., 2002; and in progress).

RANGEWIDE STATUS

Global Rank: G3 vulnerable; The global rank of G3 is assigned to species that have been recorded from between 21 and 100 localities. The Northern cavefish copepod has not been recorded from this many localities, but the G-rank is being suggested as a presumption of the occurrence of the copepod as reflected by the occurrence of the host cavefish. This may be an over-estimate of the abundance of the copepod.

Indiana State Rank: S3 vulnerable; The state rank of S3 is similarly assigned to species that have been recorded from between 21 and 100 localities. The Northern cavefish copepod has not been recorded from this many localities, but the S-rank is being

suggested as a presumption of the occurrence of the copepod as reflected by the occurrence of the host cavefish. Again, this may overstate the abundance of the copepod.

POPULATION BIOLOGY AND VIABILITY

Nothing is known of the population biology of Cauloxenus stygius, except that during at least one part of its life cycle it is ectoparasitic on cavefish. The status of the host organism, the Northern cavefish, was evaluated by Pearson & Boston (1995). The fish continues to occur in mostly small populations in suitable caves throughout its range.

POTENTIAL THREATS

This species is vulnerable to anything that threatens the Northern cavefish or the base level groundwaters that the fish inhabit. Potential threats to Amblyopsis spelaea were discussed at length by Keith (1988). The status of the host fish was evaluated by Pearson & Boston (1995) thus also passively including the status of the parasites of the fish.

The Wesley Chapel Gulf Cave System is particularly susceptible to groundwater contamination since it is one of the most extensive cave systems in Indiana, almost all of which lies under privately owned land. Many opportunities for fecal contamination, including septic field waste, outhouses, barnyard feedlots and grazing pastures exist in the area (Harvey and Skeleton; Quinlan and Rowe, 1977, 1978; Lewis, 1993; Panno, et al 1996, 1997, 1998). Chemical contamination including pesticides, herbicides and fertilizers used for crops is undoubtedly occurring, also (Keith and Poulson, 1981; Panno, et al. 1998). Some degree of hazardous material threat exists due to the potential of accidental spills or deliberate dumping, including road salting (Quinlan and Rowe, 1977, 1978; Crawford, 1985; Lewis, 1993, 1996).

Cave stream habitat alteration due to sedimentation is particularly threatening in the Lost River basin due to farming, although any other kind of development that disturbs groundcover offers the same potential problems. Sedimentation changes cave habitat by blocking recharge sites or altering flow volume and velocity. Observation of the obvious sediment load of floodwaters in Lost River attests to the magnitude of the sedimentation problem there. Furthermore, Keith (1988) reported that pesticides and other harmful compounds like PCB's can adhere to clay and silt particles and be transported via sedimentation.

With the presence of humans in caves comes an increased risk of vandalism or littering of the habitat, disruption of habitat and trampling of fauna, introduction of microbial flora non-native to the cave or introduction of hazardous materials (e.g., spent carbide, batteries) (Elliott, 1998; Peck, 1969). The construction of roads or trails near cave entrances encourages entry. Entrance to the Wesley Chapel Gulf Cave is restricted due to the gating of two of the three entrances.

SUMMARY OF LAND OWNERSHIP AND EXISTING HABITAT PROTECTION

The localities from which the Northern cavefish copepod or its host cavefish have been noted occur on a variety of federal, state and privately owned lands. On the Hoosier National Forest the Northern cavefish either occurs or has been reported (Keith, 1988) from Dillon, Elrod, Wesley Chapel Gulf, Springs Spring caves and Pioneer Mothers Spring (all in Orange County). If the confusing record of the copepod by Blatchley (1897) does in fact refer to Lost River, as I believe it does, then the Northern cavefish copepod should occur in Wesley Chapel Gulf Cave. Elrod and Wesley Chapel Gulf caves occur in the Wesley Chapel Gulf Special Area and Pioneer Mother's Spring is in the Pioneer Mother's Memorial Forest. Henshaw Bend Cave is on HNF property adjacent to the Tincher Special Area. Special areas receive management to protect the ecosystems within them (USDA Forest Service, 2000).

In addition, Poulson (personal communication) reported seeing the copepod on a fish in the Donaldson Cave System in Spring Mill State Park (Indiana Department of Natural Resources).

SUMMARY OF MANAGEMENT AND CONSERVATION ACTIVITIES

There are no species specific management activities being conducted for Cauloxenus stygius. Cave and karst habitat located on the Hoosier National Forest are, however, subject to standards and guidelines for caves and karst protection and management as outlined in the Hoosier National Forest Land and Resource Management Plan (Forest Plan) (USDA Forest Service, 1991). These standards and guidelines include the following:

> *Caves are protected and managed in accordance with the Federal Cave and Karst Resources Protection Act of 1988, Forest Service Manual 2353, Memorandums of Understanding between the forest service and the National Speleological Society, the Indiana Karst Conservancy, Inc., the Forest Cave Management Implementation Plan, and individual specific cave management plans.
>
> *Except where modified by an existing cave management prescription, vegetation within a 150-200 foot radius of cave entrances and infeeder drainages with slopes greater than 30 percent will generally not be cut. No surface disturbing activities will be conducted on any slopes steeper than 30 percent adjacent to cave entrances. Similar protection areas will be maintained around direct drainage inputs such as sinkholes and swallow holes known to open into a cave's drainage system of any streams flowing into a known cave.
>
> *Allow no sediment from erosion of access roads and drilling sites to wash into caves or karst features.

*Seismic surveys requiring explosives shall not be conducted directly over known cave passages or conduits.

*All caves will be managed as significant.

(USDA Forest Service, 1991)

The forest plan includes a cave and karst management implementation plan. This management plan places an emphasis on cave resource protection and mitigation. Understanding of the caves is established through mapping, bioinventory, cataloging of resources (e.g., archaeological, paleontological, speleothems, etc.), and estimating use levels and trends. Protection zones or other mitigation measures recommended by a management prescription will be established around caves entrances, sinkholes and swallowholes. Specific criteria will include consideration for protection of entrance and cave passage microclimate, animals inhabiting the cave, physical and chemical parameters and aesthetic values associated with the cave.

RESEARCH AND MONITORING

No species specific monitoring of Cauloxenus stygius is being conducted. A bioinventory of caves of the Hoosier National Forest, including the cavefish and its symbionts, is being conducted (Lewis, et al., 2002; and in progress). A survey of cavefish in the Hoosier National Forest is also being conducted (Pearson, in progress).

RECOMMENDATIONS

This is a very rare animal that should remain on the list of Regional Forester Sensitive Species.

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